<u>TRANSLATION</u>

(19) JAPANESE PATENT OFFICE (JP)
(12) Official Gazette for Kokai Patent Applications (A)
(11) Japanese Patent Application Kokai Publication No. H11-289701
(43) Kokai Publication Date: October 19, 1999

---

(51) Int. Cl.[6]	Ident. Symb.	Intrabureau No.	F1	Tech. Indic.
H 02 K 3/18			H 02 K 3/18	P
3/34			3/34	B
19/10			19/10	A

Request for Examination: None submitted
Number of Claims [4] OL
(Total of 5 pages in the original Japanese)

---

(21) Application Filing No. H10-91798
(22) Application Filing Date April 3, 1998

(71) Applicant 000003997
Nissan Motor Co., Ltd.
2 Takara-cho, Kanagawa-ku
Yokohama City, Kanagawa Prefecture

(72) Inventors T. Oki, Nissan Motor Co., Ltd.
2 Takara-cho, Kanagawa-ku
Yokohama City, Kanagawa Prefecture

M. Katsu, Nissan Motor Co., Ltd.
2 Takara-cho, Kanagawa-ku
Yokohama City, Kanagawa Prefecture

M. Tsukamoto, Nissan Motor Co., Ltd.
2 Takara-cho, Kanagawa-ku
Yokohama City, Kanagawa Prefecture

T. Hatsuda, Nissan Motor Co., Ltd.
2 Takara-cho, Kanagawa-ku
Yokohama City, Kanagawa Prefecture

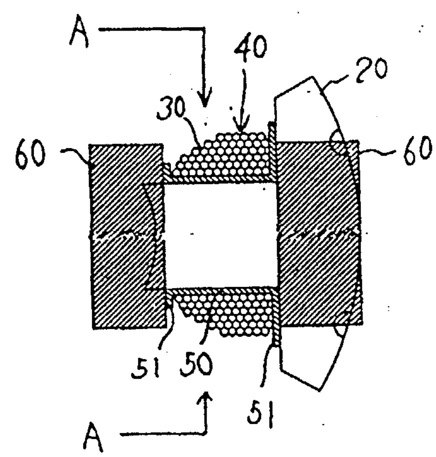
(74) Agent M. Hatta

(54) **[Title of the Invention]** Stator of Reluctance Motor

(57) **[Abstract]**

[Object] To provide a reluctance motor stator with outstanding electromagnetic performance, by forming electrodes from layered cores, without caulking or welding the tip parts of the electrodes.

[Means] A stator ***10*** of reluctance motor in which is formed a winding part ***40*** in which coils ***30*** are wound for each of a plurality of layered cores ***20*** divided in the direction of an output shaft for each electrode unit, said plurality of layered cores being combined to a cylindrical shape. The winding part ***40*** is formed to reduce the number of windings of the coils ***30*** from the outer circumference side to the inner circumference side of the layered cores ***20***, and the winding tension on the side with the reduced number of windings is higher than on the other side.



[Claims of the Invention]

[Claim 1] Stator of reluctance motor in which is formed a winding part in which coils are wound for each of a plurality of layered cores divided in the direction of an output shaft for each electrode unit, said plurality of layered cores being combined to a cylindrical shape, and characterized in that said winding part is formed to reduce the number of windings of the coils from the outer circumference side to the inner circumference side of the layered cores, and the winding tension on the side with the reduced number of windings is higher than on the other side.

[Claim 2] A reluctance motor stator of Claim 1, characterized in that a spacer is attached at the outer circumference of each layered core, at least to cover the corner part thereof.

[Claim 3] A reluctance motor stator of Claim 2, characterized in that said spacer is formed from a highly rigid material.

[Claim 4] A reluctance motor stator of Claim 2, characterized in that said spacer is formed so that it increases in thickness from the outer circumference side to the inner circumference side of the layered cores.

[Detailed Description of the Invention]

[0001]

[Field of Technology of the Invention] The present invention relates to a stator of a reluctance motor, and in particular, to a stator in which layered cores divided in the direction of an output shaft for each electrode unit are combined into a cylindrical shape.

[0002]

[Prior Art] Heretofore, stators of reluctance motors were known in which is formed a winding part in which coils are wound for each of a plurality of layered cores divided in the direction of an output shaft for each electrode unit, said plurality of layered cores being combined to a cylindrical shape.

[0003] Accordingly, due to the fact that the stator is divided for each electrode unit, it is possible to readily carry out the coil-winding operation for each layered core, so as to enhance the efficiency of producing reluctance motors.

[0004]

[Problems to be Solved by the Invention] However, since the above-described prior art stator had electrodes formed by the layering of thin copper sheets, it was necessary to caulk and weld the tip parts of the electrodes, so that the electrodes would not become misaligned. There was thus the resulting drawback that the electromagnetic performance was affected at the caulking and welding sites, which lowered the performance of the reluctance motors.

[0005] The present invention is provided in view of the above-described state of affairs, and has as its first object to provide a reluctance motor stator with outstanding electromagnetic performance, due to the fact that electrodes are formed from layered cores, without caulking or welding the tip parts of the electrodes.

[0006] A second object of the present invention is to provide a reluctance motor stator without winding insulation damage, even in cases where the coil tension is high at the winding parts to prevent electrode misalignment.

[0007] A further object of the present invention is to provide a good reluctance motor stator without raising the coil tension beyond what is necessary at the winding parts to prevent electrode misalignment.

[0008]

[Means for Solving These Problems] In order to achieve the above-described objects, the invention of Claim 1 is a stator of reluctance motor in which is formed a winding part in which coils are wound for each of a plurality of layered cores divided in the direction of an output shaft for each electrode unit, said plurality of layered cores being combined to a cylindrical shape, and characterized in that said winding part is formed to reduce the number of windings of the coils from the outer circumference side to the inner circumference side of the layered cores, and the winding tension on the side with the reduced number of windings is higher than on the other side.

[0009] By virtue of having such a structure, when the winding part is formed, the layered cores can form an integral whole without caulking or welding the tip parts of the electrodes, since the winding tension on the side with the reduced number of windings is higher than on the other side, making it possible to prevent misalignment of the electrodes. Accordingly, there is no decrease in electromagnetic performance at caulking or welding sites.

[0010] Furthermore, the invention of Claim 2 is characterized in that, in addition to the characteristic of Claim 1, a spacer is attached at the outer circumference of each layered core, at least to cover the corner part thereof.

[0011] By virtue of having such a structure, when the winding part is formed, the coils do not directly touch the corner parts of the layered cores, since the outer circumference part of the layered cores is covered with a spacer. Accordingly, there is no winding insulation damage at the corner parts of the layered cores, even when the winding tension is high.

[0012] Moreover, the invention of Claim 3 is characterized in that, in addition to the characteristic of Claim 2, said spacer is formed from a highly rigid material.

[0013] By virtue of having such a structure, the layered cores can be pressed together to form an integral whole, by forming the spacer from a highly rigid material. Accordingly, the layered cores can form an integral whole without raising the winding tension above what is necessary.

[0014] In addition, the invention of Claim 4 is in characterized that, in addition to the characteristic of Claim 2, said spacer is formed so that it increases in thickness from the outer circumference side to the inner circumference side of the layered cores.

[0015] By virtue of having such a structure, the spacer thickness differs between the outer circumference side and the inner circumference side of the layered cores, and the spacer is thicker at the inner circumference side. Accordingly, the rigidity of a spacer positioned at the inner circumference side of the layered cores is high, making it possible press the layered cores together to form an integral whole, even if the spacer is not formed from a highly rigid material. Accordingly, just as in cases where spacers are formed from highly rigid materials, the layered cores can form an integral whole without increasing the winding tension above the necessary level.

[0016]

[Advantageous Effects of the Invention] Since the present invention possesses the above structure, it can exhibit the advantageous effects described below.

[0017] In accordance with the present invention reluctance motor stator of Claim 1, a winding part is formed with the winding tension on the side with the reduced number of coil windings higher than on the other side.

[0018] Consequently, the layered cores can form an integral whole, making it possible to prevent misalignment of the electrodes without caulking or welding the tip parts of the layered cores. Accordingly, the reluctance motor performance can be enhanced without a reduction in electromagnetic properties at caulking or welding sites.

[0019] Furthermore, since there is no need to apply strong tension to the entire coil, coil stretching can be kept to a minimum.

[0020] In accordance with the present invention reluctance motor stator of Claim 2, the outer circumference of the layered cores is covered with a spacer, forming a winding part.

[0021] Consequently, since a spacer is present between the corner part of the layered cores and the coils, there is no winding insulation damage, even when the coil tension is high.

[0022] In accordance with the present invention reluctance motor stator of Claim 3, a spacer is formed from a highly rigid material.

[0023] Consequently, the layered cores can be pressed together by the spacer to form an integral whole. Accordingly, the layered cores can form an integral whole without increasing the winding tension above the necessary level.

[0024] In accordance with the present invention reluctance motor stator of Claim 4, the spacer becomes thicker at the inner circumference side of the layered cores.

[0025] Consequently, the layered cores can be pressed together to form an integral whole, by increasing the rigidity of the spacers positioned at the inner circumference of the layered cores, without using highly rigid materials to form the spacers. Accordingly, the layered cores can form an integral whole without increasing the winding tension above the necessary level, as in the case when the spacers are formed from highly rigid materials.

[0026]

[Embodiments of the Invention] Examples of embodiments of the present invention are described below on the basis of drawings.

[0027] FIG. 1 to FIG. 4 show the present invention reluctance motor stator. FIG. 1 is a lateral sectional view of a stator divided for each electrode unit. FIG. 2 is a vertical sectional view of a stator divided for each electrode unit. FIG. 3 is a view of the section indicated by the arrows A-A in FIG. 1. FIG. 4 is a lateral sectional view illustrating the entire structure. It should be noted that the coil is omitted from FIG. 3.

[0028] As shown in FIG. 4, the present invention reluctance motor stator ***10*** has a winding part ***40*** with a coil ***30*** for each of a plurality of layered cores ***20*** divided in the direction of an output shaft for each electrode unit, and this plurality of layered cores ***20*** is combined into a cylindrical shape.

[0029] The coil ***30*** is wound onto the stator ***10*** using a winder ***100***. FIG. 7 is a diagram explaining the winder ***100***. The winder ***100*** possesses a main body ***55*** which has 2 guide parts ***120*** that can rotate, and a winding rod ***56*** operated by the main body ***55*** so as to move in the X, Y, and Z directions. Coils discharged from a coil bundle ***300*** are conducted to the winding rod ***56*** through the guide parts ***120***.

[0030] The stator ***10*** rotates axially parallel to the X direction of the winding rod ***56***, and coils discharged from the winding rod ***56*** are wound. The turning position and tension of the coils are adjusted by the movement in the directions of the X-axis, Y-axis, and Z-axis of the winding rod ***56***. That is to say, in this embodiment, the more the turning position is oriented toward the I side (inside of the stator ***10***) of the X-axis of the winding rod ***56*** shown in FIG. 8, the more the winding rod ***56*** operates so that the coil is strongly wound on the stator ***10***.

[0031] Layered cores ***20*** that forms each electrode are formed by layering thin copper sheets, as shown in FIG. 1 to FIG. 3. Furthermore, the layered cores ***20*** is covered above and below by a pair of spacers ***50*** formed from non-magnetic synthetic resin insulators inserted above and below the outer circumference part of the layered cores ***20***. As shown in FIG. 1 and FIG. 2, the spacer ***50*** has a flange ***51*** facing outward at both ends at the outer circumference side and the inner circumference side of the layered cores ***20***, and, as shown in FIG. 3, it has a cross-sectional configuration shaped like brackets [ ] to cover the layered cores ***20***.

[0032] It should be noted that the spacer ***50*** is preferably formed from a highly rigid material. That is to say, by forming the spacer ***50*** from a highly rigid material, it is possible to increase the force to press the laminated cores ***20*** formed from thin copper sheets into an integral whole.

[0033] Furthermore, as shown in FIG. 1 and FIG. 2, when the coil ***30*** is wound onto the laminated coil ***20***, a pair of upper and lower immobilizers ***60*** is used to immobilize the layered cores ***20*** and the spacer ***50***. That is to say, due to the pair of upper and lower immobilizers ***60***, both flanges ***51*** of the spacer ***50*** are inserted, and the layered core ***20*** is inserted vertically, so as to immobilize the layered core ***20*** and the spacer ***50***, and winding is carried out by rotating the layered cores ***20*** and the spacer ***50***. The immobilizer ***60*** is removed after winding.

[0034] Said winding part ***40*** is formed by winding the coil ***30*** so as to reduce the number of windings of the coil from the outer circumference side to the inner circumference side of the layered cores ***20***. The reason why the number of windings on the outer circumference side of the layered cores ***20*** is greater than on the inner circumference side is that, when

forming the stator ***10*** by combining the electrodes formed from the layered cores ***20*** into a cylindrical shape, the space on the outer circumference side of the layered cores ***20*** will be greater than on the inner circumference side, and such a winding structure can ensure a sufficient number of windings to form electrodes.

[0035] Moreover, when forming the winding part ***40*** by winding the coils ***30*** on the layered cores ***20***, the winding tension on the side with a reduced number of windings (the inner circumference side of the layered cores ***20***) is greater than that on the other side (the outer circumference side of the layered cores ***20***). That is to say, by detecting the turning position of the coil, and raising the tension of the coil toward the side with a reduced number of windings (the inner circumference side of the layered cores ***20***), the winding part ***40*** is formed.

[0036] Next, another working example of a spacer is described on the basis of FIG. 5 and FIG. 6.

[0037] FIG. 5 and FIG. 6 show a spacer ***70*** of another working example. FIG. 5 is a lateral sectional view of a stator divided for each electrode unit. FIG. 6 is a vertical sectional view of a stator divided for each electrode unit.

[0038] The spacer ***70*** of another working example is formed so as to increase the thickness from the outer circumference side to the inner circumference side of the layered cores ***20***. That is to say, this spacer ***70*** is inclined so that the winding surface of the coils ***30*** grows from the inner circumference side to the outer circumference side of the layered cores ***20***. By virtue of the fact that the spacer ***70*** has this structure, it is possible to raise the rigidity of the spacer ***70*** positioned at the inner circumference side of the layered cores ***20***, without forming the spacer ***70*** from a highly rigid material, and making it possible to increase the force to press the laminated cores ***20*** into an integral whole.

[0039] In the above-described embodiment, due to the fact that the winding tension on the side with the reduced number of windings in the winding part ***40*** is higher than on the other side, it is possible to form an integral whole without caulking or welding the tip parts of the layered cores ***20***, making it possible to prevent misalignment of the electrodes. Accordingly, there is no decrease in electromagnetic performance at caulking or welding sites.

[0040] Furthermore, in this embodiment, due to the fact that the spacer ***50*** covers the outer circumference of the layered cores ***20***, the coils ***30*** do not directly touch the corner part of the layered cores ***20***. Accordingly, there is no winding insulation damage at the corner parts of the layered cores, even when the winding tension of the coils ***30*** is high.

[0041] In addition, in this embodiment, due to the fact that the spacer ***50*** is formed from highly rigid material, the layered cores ***20*** can be pressed to form an integral whole. Accordingly, the layered cores ***20*** can form an integral whole without increasing the winding tension above the necessary level.

[0042] Moreover, in this embodiment, due to the fact that the spacer thickness differs between the outer circumference side and the inner circumference side of the layered cores ***20***, and the spacer ***70*** is thicker at the inner circumference side. Accordingly, the rigidity of the spacer ***70*** positioned at the inner circumference side of the layered cores ***20*** can be increased, even without forming the spacer ***70*** from highly rigid materials, making it possible to press the layered cores ***20*** to form an integral whole. Accordingly, the layered cores ***20*** can be formed into an integral whole, without increasing the winding tension of the coil ***30*** above the necessary level, just as in the case where the spacer ***70*** is formed from highly rigid material.

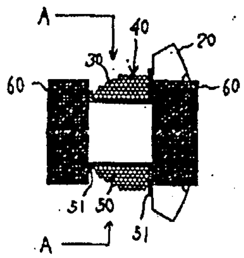
[Brief Description of the Drawings]

[FIG. 1] A lateral sectional view of a stator divided for each electrode unit.
[FIG. 2] A vertical sectional view of a stator divided for each electrode unit.
[FIG. 3] A view of the section indicated by the arrows A-A in FIG. 1.
[FIG. 4] A lateral sectional view illustrating the entire structure of the present invention clearance motor stator.
[FIG. 5] A lateral sectional view of a stator divided for each electrode unit, illustrating the spacer of another working example.
[FIG. 6] A vertical sectional view of a stator divided for each electrode unit, illustrating the spacer of another working example.
[FIG. 7] A diagram showing a general explanation of the winder.
[FIG. 8] A diagram explaining the winding method of the coil of the present invention.

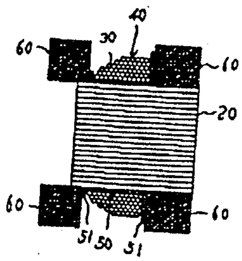
[Explanation of the Reference Numbers]

10 ..... Stator
20 ..... Layered core
30 ..... Coil
40 ..... Winding part
50, 70 ..... Spacer
51 ..... Flange
56 ..... Winding rod
60 ..... Immobilizer
100 ..... Winder

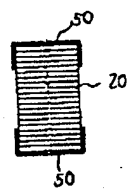
[FIG. 1]



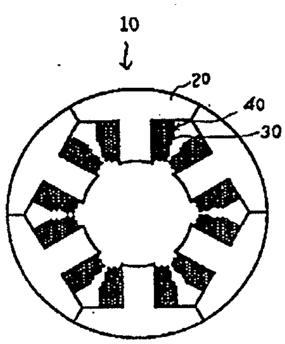
[FIG. 2]



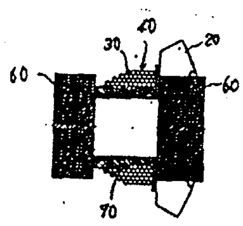
[FIG. 3]



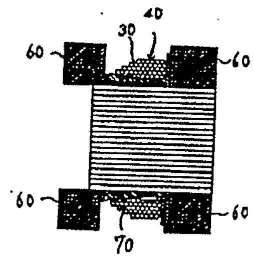
[FIG. 4]



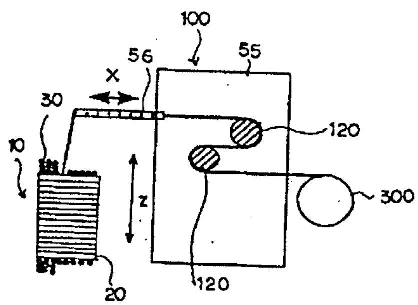
[FIG. 5]



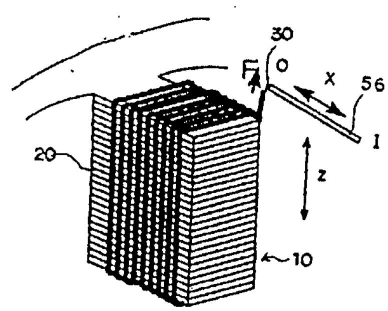
[FIG. 6]



[FIG. 7]



[FIG. 8]



Translated by John F. Bukacek (773/508-0352)